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PATENT
Atty. Dkt AMAT/6346/PPC/ECP/RKK

IN THE CLAIMS:

Please amend claims 5-7, 9-17, 21, 23, 24, 26, and 27 without prejudice:

1. (Original) A method for reducing organic depletion in an electrochemical plating apparatus, comprising:
determining a volumetric organic depletion per unit time for at least one electrochemical plating current density; and
modifying an electrochemical plating processing recipe to include real time replenishment of depleted organics in accordance with the determined volumetric organic depletion per unit time.
2. (Original) The method of claim 1, wherein determining a volumetric organic depletion per unit time for at least one electrochemical plating current density comprises conducting a test run process, the test run process comprising:
determining an initial organic concentration in an electrolyte solution;
operating the electrochemical plating apparatus using the electrolyte solution at a predetermined current density for a predetermined duration;
determining a final organic concentration of the electrolyte solution; and
determining the volumetric organic depletion per unit time for the electrochemical plating apparatus at the predetermined current density from the determined initial organic concentration and the determined final organic concentration.
3. (Original) The method of claim 2, wherein operating the electrochemical plating apparatus using the electrolyte solution at a predetermined current density for a predetermined duration further comprises operating the electrochemical plating apparatus at a plurality of predetermined current densities, wherein the plurality of predetermined current densities correspond to normal operational current densities of the electrochemical plating apparatus.

4. (Original) The method of claim 2, wherein determining the volumetric organic depletion per unit time comprises determining organic concentration differential and calculating the volumetric organic depletion from the organic concentration differential.

5. (Currently Amended) The method of claim 1, wherein modifying an electrochemical plating processing recipe to include real time replenishment of depleted organics comprises including process control steps in the plating processing recipe that to provide for real-time replenishment of organics in accordance with the determined volumetric organic depletion per unit time for a specific current density used in a recipe step.

6. (Currently Amended) The method of claim 1, wherein modifying the electrochemical plating processing recipe comprises:

determining a current density used in a the recipe step;

determining a corresponding volumetric depletion of organics per unit time; and

modifying the recipe step to include replenishment of the determined corresponding volumetric depletion of organics per unit time.

7. (Currently Amended) The method of claim 1, wherein real-time replenishment comprises replenishment of the depleted organics during a recipe step ~~within which while~~ the depleted organics were are depleted from the electrolyte solution.

8. (Original) The method of claim 1, wherein a microprocessor-type controller is utilized to determine the volumetric organic depletion and to modify the electrochemical plating processing recipe.

9. (Currently Amended) A method for real-time replenishment of organics in an ~~electroplating~~ electrochemical plating system, comprising:

conducting a test run process for the ~~electroplating~~ electrochemical plating system;

determining a volumetric depletion per unit time of at least one organic substance from an electrolyte solution from the test run process; and

modifying an electroplating processing recipe to include volumetric replenishment per unit time of a depleted organic in accordance with the determined volumetric depletion per unit time.

10. (Currently Amended) The method of claim 9, wherein conducting a test run process comprises:

determining at least one normal operational current density for the electroplating electrochemical plating system;

operating the electrochemical plating system for a predetermined time interval at the at least one normal operational current density; and

determining a concentration gradient of an organic substance in an electrolyte solution of the electrochemical plating system.

11. (Currently Amended) The method of claim 10, wherein determining a concentration gradient comprises:

determining an initial organic concentration prior to operating the electrochemical plating system;

determining a final organic concentration subsequent to operating the electrochemical plating system; and

calculating the concentration gradient from the initial organic concentration and the final organic concentration.

12. (Currently Amended) The method of claim 10, wherein determining at least one normal operational current density comprises determining at least one current density for the electroplating electrochemical plating system that is used in a processing recipe.

13. (Currently Amended) The method of claim 9, wherein operating the electrochemical plating system for a predetermined time interval at the at least one normal operational current density comprises:

operating the plating system at a predetermined electrochemical plating current density;

~~incrementing~~ incrementally adjusting the predetermined electrochemical plating current density; and

repeating the operation of the electrochemical plating system at after the incremented incrementally adjusting the predetermined electrochemical plating current density.

14. (Currently Amended) The method of claim 9, wherein modifying an ~~electroplating~~ electrochemical plating processing recipe to include volumetric replenishment per unit time of a depleted organic comprises adding a process control element ~~into to the electroplating~~ electrochemical plating processing recipe, wherein the process control element is configured to control a replenishment unit configured to add organics to an electrolyte solution.

15. (Currently Amended) The method of claim 9, wherein conducting a test run process, determining a volumetric depletion per unit time, and modifying an ~~electroplating~~ electrochemical plating processing recipe ~~comprises~~ comprise using a microprocessor-type controller configured to receive inputs from the electrochemical plating system and generate control signals for the electrochemical plating system.

16. (Currently Amended) A method for replenishing depleted organics in an electrolyte solution within a semiconductor processing recipe ~~step~~, comprising:

conducting a plurality of electrochemical plating test runs, each of the plurality of plating test runs ~~being~~ conducted at an individual current density;

determining an organic volumetric depletion per unit time for each of the individual current densities; and

replenishing organics into the electrolyte solution during the processing recipe step in accordance with the determined volumetric depletion per unit time.

17. (Currently Amended) The method of claim 16, wherein conducting a plurality of electrochemical plating test runs comprises operating an electrochemical plating system at a plurality of ~~desired~~ individual current densities for predetermined periods of time.

18. (Original) The method of claim 17, wherein the plurality of desired current densities correspond to normal operational current densities of the electrochemical plating system.

19. (Original) The method of claim 16, wherein determining an organic volumetric depletion per unit time for each of the individual current densities comprises:

measuring an initial organic concentration prior to conducting an electrochemical plating test run;

measuring a final organic concentration subsequent to conducting the electrochemical plating test run;

determining a concentration gradient between the initial organic concentration and the final organic concentration;

calculating the organic volumetric depletion from the concentration gradient; and

calculating the organic volumetric depletion per unit time.

20. (Original) The method of claim 19, wherein calculating the organic volumetric depletion per unit time comprises dividing the calculated organic volumetric depletion by a test run duration.

21. (Currently Amended) The method of claim 16, wherein replenishing organics into the electrolyte solution during the semiconductor processing recipe comprises including a time variant volumetric replenishment element in each plating recipe step of the semiconductor processing recipe, wherein the time variant volumetric

replenishment element ~~corresponding~~ corresponds to an input to a replenishment device configured to add organics to the electrolyte solution.

22. (Original) The method of claim 16, wherein replenishing organics into the electrolyte solution during the semiconductor processing recipe comprises adding fresh organic material to the electrolyte solution, wherein the added fresh organic material corresponds to depleted organic material.

23. (Currently Amended) The method of claim 22, wherein the adding process occurs ~~in a~~ as real time manner-replenishment.

24. (Currently Amended) The method of claim 16, wherein the conducting, the determining, and the replenishing steps are controlled by a microprocessor-type controller.

25. (Original) The method of claim 16, further comprising modifying an electroplating processing recipe to include process control over a replenishment device, wherein the replenishment device is configured to add a volumetric quantity of fresh organic material to the electrolyte solution, the volumetric quantity of fresh organic material corresponding a volumetric quantity of depleted organic material.

26. (Currently Amended) A method for real-time replenishment of depleted organics in an electrolyte solution, comprising:

measuring a concentration of depleted organics in the electrolyte solution during a processing step;

transmitting the measured concentration to a system controller;

determining a replenishment of organics corresponding to the measured concentration of depleted organics with the system controller; and

replenishing organics into the electrolyte solution during the processing step in accordance with the determined replenishment of organics.

27. (Currently Amended) The method of claim 26, wherein the measuring step is conducted via a CVS assembly.

28. (Original) The method of claim 26, wherein the system controller is configured to receive measurement inputs, calculate replenishment volumes, and control a replenishment device.

29. (Original) The method of claim 28, wherein the replenishment device is a chemical cabinet in fluid communication with the electrolyte solution.

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